

should be looked for at other points in New England and New York. Its occurrence with *Betula pumila*, *Salix candida*, *Carex Schweinitzii*, and other characteristic swamp plants of the Berkshire and Taconic Mountain region, indicates that it may be sought with some confidence in Bennington County, Vermont, and with real assurance in Dutchess and Columbia Counties, New York. In fact, the junction of these two counties of New York with Litchfield County, Connecticut, is at the base of Mount Riga, just north of the State Line swamp where *Salix serissima* was first studied by the writer. Larch swamps to all appearances the same extend westward from northern Litchfield County nearly to the Hudson Valley, and are characterized¹ by *Betula pumila*, *Salix candida*, *Valeriana sylvatica*, *Viburnum Opulus*, *Cypripedium spectabile*, *Carex Schweinitzii*, *C. tetanica*, *C. teretiuscula*, var. *ramosa*, etc., all of which with the exception of *Valeriana* (abundant only three miles west of Salisbury) are among the typical plants of the Stockbridge or the Salisbury marshes; while many of them occur with *Salix serissima* in the swamps of northern New Jersey, in the famous Bergen Swamp of Genesee County, New York, or in the marshes near Cayuga Lake. It will, then, be indeed surprising if an exploration of similar tracts fails to reveal in eastern New York, as in western Massachusetts, northwestern Connecticut, northern New Jersey, and northwestern New York, *Salix serissima* as a companion of these notable species.

GRAY HERBARIUM.

NOTES ON NEW ENGLAND VIOLETS.

E. BRAINERD.

(Plate 50.)

A MOST noteworthy instance of the segregation of an old species is to be found in the recent treatment of the common blue violet. The polymorphous group of plants included in the last edition of the Gray Manual under *Viola palmata* and its var. *cucullata*, it is now proposed to divide up into at least thirty species.

This radical treatment of a common and familiar plant, though not

¹ See L. H. Hoysradt, Bull. Torr. Cl. VI. appendix.

without precedent, naturally challenges our attention and criticism. Even an amateur student of botany may be tempted to scrutinize the facts that appear in his limited field of observation. That the reader may understand upon what data the present article is based, the writer may perhaps be pardoned for saying, that for the past two seasons his botanical field work from May to October has been almost entirely devoted to this genus, that he has collected and examined some two or three thousand plants from over two hundred stations in Western Vermont and Western Massachusetts, and that much of his material has been examined and discussed by expert students of the genus. His purpose is to put on record certain facts of observation that may prove of interest, and to give the results of his study as to specific limitations.

I desire to express herewith my grateful appreciation of the courtesies and assistance that I have received in the course of my studies from Mr. C. L. Pollard of the National Museum, from Prof. Greene of the Catholic University, and from Dr. Robinson of the Gray Herbarium. I am also under great obligation to numerous friends for the use of valuable material from many localities.

It is only in recent years that students of our violets have paid attention to the development of the plant during the summer months. In the Synoptical Flora (1895) the specific characters are taken almost exclusively from the plants as they appear when flowering in Spring, though the existence of later cleistogamous flowers, "abundant and short peduncled," is stated. Even Mr. Pollard, who has distinctly urged the importance of studying the mature plant, is, in his treatment of *Viola* in the recent Manuals of Dr. Britton and of Dr. Small, quite vague in his account of the apetalous flowers and their mature capsules. Yet right here are to be found the most marked and constant characters on which to divide the acaulescent blue violets into species. These plants are best understood, as are the Cruciferae and Umbelliferae, *when in fruit*.

This is indeed what might have been expected from certain well known biological laws. In the evolution of species the most marked differences are found to appear when the individual has reached the climax of its life-history. The young of allied species are more alike than the adults. An herbaceous plant in its vernal state, even though in flower, has often less pronounced characters than when in summer or autumn it has attained its full size and produced its seed. "By their fruits ye shall know them."

It may be well here to rehearse briefly the methods of reproductive economy that prevail in those species of *Viola* that have neither stems nor stolons. The petaliferous flowers that appear in May have a special mechanism that ensures cross-fertilization. They are believed to be sterile unless visited by insects with pollen from another flower. Their infertility has been often observed, especially in foreign gardens, from which doubtless the requisite insects were absent. But in the wild I have, during the past season, found these capsules to be usually fertile. It takes three or four weeks from the time of flowering for the capsule to ripen its seeds. It then splits into three boat-shaped valves with very thick rigid keels. As the thin sides of the valve dry and contract, the seeds within are more and more pinched, until they fly out, one or two at a time, to a distance of several feet. (See RHODORA, iv. 183 & 230.)

Soon after petaliferous flowering, the plant begins to produce from the crown of the rootstock minute, apetalous, self-fertilized flowers on peduncles that are short and horizontal, or long and ascending, according, for the most part, as the plant grows in a dry or in a wet situation. But in all cases as the capsule ripens, the peduncle lengthens; and the effort of the plant is to lift the capsule into the air, and to raise it from a nodding to an erect position, after which it opens and scatters its seeds, as did the earlier capsules. When thickly covered with dead leaves the blanched peduncles are often six or more inches in length, and may never succeed in getting the ripe capsules up into the air. But I certainly have never discovered in the "cleistogenes" any "tendency to bury themselves deep in the ground instead of remaining close to the surface," such as Mr. Pollard attributes to *V. domestica*, Bicknell. (Bot. Gaz. xxvi, 337.) The mature capsules of all species are normally "aerial" and not "hypogaeous."

A vigorous plant under favorable circumstances, especially in the open, will continue to bear fruit from cleistogamous flowers from July till the last of October. The cool wet weather of last August was specially favorable for all species of violets, and they bore abundant fruit in the autumn. The capsules of the apetalous flowers usually differ somewhat in appearance from those of the petaliferous flowers. They have this advantage for purposes of study that they may be had at almost any time during a period of three or four months. It is upon differences that are found in the apetalous flowers and their

capsules — differences in shape, size, color, in form of sepals and of auricles — that I believe specific distinctions in the acaulescent violets can be most satisfactorily based. These characters prove to be fairly constant; they seem to have no “biological importance,” and so are not subject to “adaptive changes,” and have, therefore (to use Dr. Gray’s terms once more), “high classificatory value.”

That the importance of these characters has hitherto escaped attention seems strange; but it may be accounted for by two facts. First, the plants are most attractive when in vernal flowering; if fruit and mature leaves are wanted, most collectors have been satisfied to collect the plants a month later, before they are injured by the drought and insects of summer but before the apetalous capsules are mature. Secondly, the capsules of the apetalous flowers, even when but half-grown, split open on drying, and the sepals shrivel, so that their characters in ordinary herbarium specimens are greatly obscured.

I present herewith a synopsis of the New England species of acaulescent, non-stoloniferous violets, with the omission of *Viola pedata*, which, since it has beardless petals and a peculiar style, Dr. Gray has placed in a group by itself.

A. Apetalous flowers subulate; their mature capsules bright green, oblong, acute, 5–15 mm. long; sepals on mature capsules lanceolate, nearly as long as the capsules; with straight auricles 2–5 mm. long. (Pl. 50, fig. 1.)

1. *V. CUCULLATA*, Ait. Plant usually glabrous; leaves broadly cordate-ovate; petaliferous flowers blue varying to white, often with a darker blue center; peduncles longer than the leaves; — springs, cold brooks and bogs, and moist soil of mountains.

B. Apetalous flowers ovoid-acuminate; their mature capsules purple, sub-globose, mostly obtuse, 4–8 mm. long; sepals on mature capsules one half as long as the capsules, with short appressed glabrous auricles. (Pl. 50, fig. 2.)

2. *V. VENUSTULA*, Greene. Plants small, glabrous throughout; leaves ovate-acuminate, 2–5 cm. wide; petals blue; peduncles about as long as the leaves; — moist, mucky borders of streams, marshes and lakes.

C. Apetalous flowers ovoid-acuminate; their mature capsules pale green, or more or less speckled with purple, oblong, acute or acutish, 8–15 mm. long; sepals one quarter to one third as long as the capsule, with short appressed commonly hispidulous auricles. (Pl. 50, fig. 3 & 4.)

* Leaves never lobed, broadly ovate or reniform, 4–12 cm. wide.

† Plants essentially glabrous; petals violet.

3. *V. LATIUSCULA*, Greene. Leaf-outline above the cordate base approximately deltoid, earliest leaves purplish on the under surface, petioles puberulent or slightly pubescent; — dry copses in sandy or sterile soil.

4. *V. PAPILIONACEA*, Pursh. Leaf-outline above the cordate base broadly orbicular, earliest leaves green on the under surface, petioles usually glabrous; — rich moist soil, often in yards and cultivated ground.
- † † Plants more or less villous-pubescent; petals light blue or lavender.
5. *V. SORORIA*, Willd. Moist rich woodlands, shady ledges, meadows and pastures.
- * * Some or all of the leaves palmately divided or lobed.
- † Plants more or less villous-pubescent; petals light blue.
6. *V. PALMATA*, L. Dry open woods and ledges.
- † † Plants nearly or quite glabrous; petals bright blue.
7. *V. SEPTEMLOBA*, LeConte. Sandy soil near the coast.
- D. Apetalous flowers sagittate on horizontal or deflexed peduncles; their mature capsules purple, subglobose, 4–6 mm. long; sepals somewhat obtuse and ciliolate, with long divergent auricles. (Pl. 50, fig. 5.)
8. *V. SEPTENTRIONALIS*, Greene. Plants pubescent or subglabrous; earliest leaves purplish on the lower surface; mature leaves ciliate, broadly ovate, 3–7 cm. wide; petioles slender, wiry, often purple at base; petals violet, with sepals closely ciliolate nearly to the tip; — dry or moist copses.
- E. Apetalous flowers sagittate on erect peduncles; their mature capsules green, ovoid or oblong, 6–14 mm. long; sepals lanceolate with long hispidulous auricles. (Pl. 50, fig. 6.)
- * Leaves pubescent, ovate-oblong, petioles usually shorter than the blades; petals violet-purple.
9. *V. FIMBRIATULA*, J. E. Smith. Dry soil.
- * * Leaves nearly glabrous, lanceolate, basal lobes spreading toothed or incised, petioles usually longer than the blades; petals deep violet.
10. *V. SAGITTATA*, Ait. Wet meadows and marshes.

I subjoin a few comments on each of these ten species.

1. *Viola cucullata*, Ait., is beautifully distinct. Prof. Greene was the first to call attention to its distinctness in Dec. 1896. (Pittonia, iii. 143 & 336.) There is, however, still some uncertainty as to whether this was the plant that Aiton had before him when he gave the name in 1789. Prof. Greene now regards the group as separable into about ten species, and names much of the Vermont material *V. prionosepala*.

The specific name — *cucullata* — is not especially appropriate except to plants that grow in open bogs; those that grow in the shade have leaves as widely spread as those of any other species. All violet leaves are involute in the bud. When expanding they have the shape of a monk's hood, the basal lobes being rolled in so as to touch each other; and when full grown, if evaporation is excessive, they all tend to revert to this natal condition. If a violet specimen is not soon put in press after it is collected, the basal lobes

will roll inward, and even the mature leaves will appear cucullate when dried. In the field I believe this character is of doubtful value; in the dried specimen it is often misleading.

Viola cucullata, more than any of its allies, affects a cold situation. It thrives near perennial springs and along cold brooks. It is the common violet of mountain regions, where it is often found on wood-roads and along highways.

This species is omitted from Dr. Small's recently published Flora of the Southern States. But there is in the Gray Herbarium a specimen of it, collected in the mountains of North Carolina by Rugel, October 1841. It has petaliferous flowers that differ from those of spring in having sepals with long auricles, such as regularly appear in the apetalous flowers. For this reason Shuttleworth considered Rugel's plant a distinct species. But numerous specimens from several localities in Western Vermont show that *Viola cucullata* not infrequently has petaliferous flowers in autumn, and that these as a rule have long-auricled sepals. A period of mild, springlike weather in autumn often causes the appearance of vernal flowers. It is as though under this impulse the life-forces of the violet got confused, and mixed the characters of its two kinds of flowers. The *V. macrotis* and the *V. leptosepala* of Greene also remind one of this "long-eared" form, which might occasionally occur in spring as well as in autumn.

2. *V. venustula*, Greene, is notably the smallest plant of the group. The type is from the vicinity of Ottawa, Ont., but the species is of frequent occurrence at low elevations in the Champlain Valley. Probably when understood the species will be found to have a much wider distribution.¹

Under division "C" we have a natural group of five species or subspecies, in which the details of flower and fruit are much alike. They are separable from one another chiefly by features that appear in the foliage — pubescence and lobation — characters which are obvious enough when fully developed, but inconstant and intergrading. In the most pronounced form of *V. palmata* the leaf is 5-7-parted; but plants with 3-5-lobed leaves (var. *dilatata*, Ell.) are perhaps more common; and growing with these are plants with

¹ I have recently seen specimens collected by Messrs. Bissell and Andrews at Lakeville in the northwest corner of Connecticut, and specimens from Willoughby Mt. collected by Mr. Eggleston.

one or more entire leaves, and still other plants with all the leaves entire. It is extremely difficult to make out how these last differ from *V. sororia*. The situation is quite the same when we consider the character of pubescence. We find specimens of *V. sororia* with dense, almost matted, pubescence on the petioles, others with sparse spreading pubescence, others with mere traces of pubescence just below the blade, and this on only one or two leaves, and finally other plants quite glabrous. Somewhere in this shifting series we pass from *V. sororia* to *V. papilionacea*. In several other species of *Viola* we find pubescence just as variable a character. *V. blanda* is sometimes quite pubescent, but often nearly or wholly glabrous; so is *V. rotundifolia*; so is *V. renifolia*. Under these circumstances it would seem that in the genus *Viola*, whatever may be the case elsewhere, pubescence, unless correlated with other characters, is not a satisfactory basis on which to found a species. Possibly these correlated characters may yet appear. Meanwhile, as I am loth to make new names or new combinations, I provisionally speak of these five forms under division "C" as species.

3. *V. latiuscula*, Greene (Pittonia, v. 93, Nov. 1902), was founded upon specimens from Twin Mts., West Rutland, Vermont. The plant proves to be of frequent occurrence in dry sterile soil in western New England and adjacent New York. It was collected by the writer in May, 1899, on the dry open sand-plains near Fort Ethan Allen, Essex, Vermont. On revisiting the station for mature leaves and fruit in June, 1903, after over fifty days of rainless weather, I found that the plant had completely disappeared. But on a third visit, September 11, after a rainy August, large plants in abundance bearing copious fruit were to be had. The plant had become as completely dormant during the summer drought as during the winter cold. Further facts tend to show that certain species of stemless violet are capable of leading a double existence, passing, with intervals of rest between, through a vernal and an autumnal stage that differ from each other in foliage, flower and fruit,—thus posing as a sort of Jekyll and Hyde among plants.¹

¹ *Viola rotundifolia*, Michx. well illustrates this; there is a marked contrast between the April plant with its small leaves and yellow flowers, and the August plant with its large leaves and chocolate cleistogamous flowers on branching peduncles (really, disguised stolons). Pursh described the latter form as a distinct species, *V. clandestina*; though he opined its connection with Michaux's species. But for this opinion he was taken to task by Schweinitz, who stoutly asserts that *V. rotundifolia* "can have no affinity whatever" with *V. clandestina*! (Am. Jour. Sci. v. 63.)

4. *V. papilionacea*, Pursh, is the name taken up in recent years by Messrs. Greene and Pollard for the common purple-flowered violet of meadows and orchards, including the form found frequently in door-yards and borders of streets (*V. domestica*, Bicknell). In New England the species is more frequently seen within fifty miles of the coast than farther inland. In habitat and general aspect it seems quite distinct from its near ally, *V. latiuscula*. But when one attempts to state the difference, as in the above synopsis, the marks of distinctness are found to be elusive,—if not illusory.

5. *V. sororia*, Willd. The colored plate that accompanies the original publication of this species represents the petioles as erect and edged with sparse spreading hairs. This is a peculiarity of the plants to which we apply the name, and there can be no reasonable doubt as to its applicability. Dr. Britton so understands the species in the Illustrated Flora (ii. 448). It is the commonest of all violets in the Champlain Valley and occurs in various situations. In wet mucky woodlands its leaves are not infrequently 40 cm. high and 15 cm. wide; in the hollows of open pastures and on sparsely wooded hillsides its leaves are usually but 7–10 cm. high and 5–7 cm. wide. In the latter situation it fruits in autumn far more abundantly than in the former.

I have included under *V. sororia*, several of Prof. Greene's species, especially his *V. cuspidata*, *V. Dicksonii*, and *V. nodosa*,—confessing my inability to make out any other than trifling or local differences between them. In Pittonia (v. 103) Prof. Greene has called attention to a singular feature that he has observed in *V. Dicksonii*:—the occurrence of underground fruit “converted into what appears to be a berry. It is evidently globose (as large as an ordinary wild gooseberry, or middle-sized pea), absolutely indehiscent, the pressed and dried pericarp being unbroken, translucent and showing the seeds that lie within, just as, in the herbarium, the seeds of many a berry-like fruit are seen through their fleshy covering in its dried state.” This is but a malformation of the capsule due to the sting of a gall-fly. A dissection of the “baccate fruit” in August shows the presence of the scarlet larvae of a species of this sort of insect. We find that at least four other species of *Viola*—*V. palmata*, *V. venustula*, *V. cucullata* and *V. septentrionalis*—are attacked in the same way, though with less frequency.

6. *V. palmata*, L., has been found in Vermont in only a few

stations from the middle of the State south along the western border, and only in the form bearing leaves with 3-5 shallow lobes. The form with deeply divided leaves I have collected as far north as Great Barrington, Mass.

7. *V. septemloba*, Le Conte, is in New England confined to the costal regions. I include under this name *V. Brittoniana*, Pollard, which I cannot regard as specifically distinct from the plant of Le Conte.

8. *V. septentrionalis*, Greene (Pitt. iii. 334). This admirable species was founded upon specimens collected by J. M. Macoun near Ottawa, Ont., in May and June, 1898. Several sheets of this collection are in the Gray Herbarium. Prof. Greene has recently made several other species, from different localities, out of what seems to be essentially the same thing as the Ottawa plant. *V. septentrionalis* he now regards as a local species, and calls the plants sent from Vermont, *V. subviscosa*. Believing as I do in their specific identity I am obliged to use Prof. Greene's oldest name, — a name, by the way, as felicitous for this northern species, as the other name is infelicitous, the plant being never in the least viscous.

At the time of vernal flowering the species might be confused with *V. sororia*, both having cordate-ovate pubescent leaves; but one soon learns to distinguish it by the rich violet of the petals and the purple coloring on the lower surface of its earliest leaves. These marks, indeed, after a few months fade out in herbarium specimens. But here I find a fairly reliable mark in the fine ciliation of the sepals extending nearly or quite to the tip. In *V. sororia* the sepals are obscurely ciliate and that chiefly at the base. When, however, one examines *V. septentrionalis* in late summer, it is seen to be more closely related to *V. fimbriatula* than to any other species. This resemblance is seen in the pubescence, in the color of the petals, in the form of the apetalous flowers and fruit, and in the ciliation and long auricles of the sepals. Nevertheless there are obvious and radical points of difference between the two species, and no one would think of merging them into one.

The species is a common one in the northern New England States. Mr. Eggleston has collected it on the cold cliffs of Smugglers' Notch. I have seen it from numerous stations in Maine and New Hampshire. Mr. Bissell has it from at least two stations in Connecticut. I have collected it in Lanesboro, Mass. In western

Vermont it is frequently found in partial shade on gravelly hillsides. It especially affects the company of young conifers, and thrives in the open groves of arbor-vitae that abound on the rocky shores of Lake Champlain.

9. *V. fimbriatula*, J. E. Smith, has been separated of late years by general consent from *V. sagittata*, and is too well known to call for special comment.

10. *V. sagittata*, Ait., has not been found in Vermont or in the Berkshire Hills. In New England it seems to be for the most part restricted to the neighborhood of the coast.

Some may query whether these closely allied species are ever found to hybridize under natural conditions. It often happens that colonies of two species are growing intermixed, and it would not be strange if occasionally a crossing should be effected in the petaliferous flowers through the agency of insects. I am aware that evidence of such crossing should be weighed with great caution and verified in all possible ways; but an important phase of this report would be omitted if I failed to state that in three instances I have found plants that had every appearance of being hybrids. One of these that I have watched for two seasons, is in flower, fruit and foliage a striking intermediate between *V. fimbriatula* and *V. sororia*; the second is an intermediate between *V. cucullata* and *V. venustula*; and the third, an intermediate between *V. septentrionalis* and *V. venustula*. In all instances the supposed parents were near at hand and numerous. Mr. Pollard, who has seen flowering specimens of the first mentioned hybrid, was inclined to regard it rather as a new species; and so it may be — possibly. But I fancy that more than one of the many new species recently proposed, based on plants from a single station, seen only in petaliferous flower, may prove on more extended observation to be hybrids. This interbreeding may, indeed, be more extensive than we have supposed, and be one of the causes of the perplexity that has attended the study of these interesting plants.

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